Closure device for a container made of laminated paper or cardboard

The present invention relates to a closure device that can be provided over a pierceable point of a closed container, the container being made of laminated paper or cardboard and comprising at least one layer of plastics film, the closure device being made of plastics material and having the features of the pre-characterising Clause of claim 1.

Closure devices of this type comprise a stopper-like lower part with a cylindrical outlet connection piece which is connected or can be connected to the container, and a screw cap which can be screwed to the lower part, and a cylindrical piercing element which is open on both sides in the axial direction and is displaceably mounted in the manner of a screw in the lower part, means being provided in the screw cap which move the piercing element downwards on the first unscrewing movement of the screw cap, the cylindrical piercing element comprising a ring with external thread and at least one cutting element directed toward the container.

Closure devices of this type are welded or glued onto the containers made of laminated paper or cardboard. The containers made of laminated paper that are of interest here have a cubical basic shape and are primarily used in packaging liquid products, in particular products from the food industry. From the outside in laminated paper or cardboard of this type accordingly comprises the following sequence of layers:

1. Polyethylene film
2. Cardboard
3. Polyethylene layer
4. Aluminium layer
5. Polyethylene layer

In this multi-layer material, which is conventionally called laminated paper, there is provided in those containers which are provided with a closure device of the type of interest here a pre-determined opening point in the laminated paper. The pre-determined opening point is a pre-punched opening in which the upper three layers are normally cut through while the two lower layers made of aluminium and polyethylene are completely intact.

During the unscrewing movement of the screw cap the closure device made of plastics material, by means of its cylindrical piercing element, cuts through the laminated paper exactly in the region of the pre-punched portion.

The exact alignment of the cylindrical outlet connection piece over the pre-punched portion, so the piercing element is caused to run exactly in the linear pre-punched portion, is usually illusory. In actual fact, it is sufficient if, during its rotating downwards movement, the cylindrical piercing element crosses this pre-punched portion with its cutting element whereupon the cutting element conventionally remains in the pre-punched portion. The tip of the cutting element normally pierces the polyethylene layer in the process and then cuts through this without difficulty. However, surprisingly this does not happen in a certain percentage of cases. This is undoubtedly connected to the toughness, elasticity and ductility of the polyethylene film although this alone would not account for this phenomenon. Accordingly theoretical considerations have to be relied on in order to clarify this problem.

The Applicant is assuming that this problem can be attributed to the fact that, on the one hand, the pre-punched portions are often inadequate and consequently only the outer polyethylene layer is cut through while the relatively thick cardboard layer is only inadequately cut and the middle polyethylene layer, if there is one, is presumably undamaged. As a result, the cutting element penetrates with its tip first into the fibrous cardboard or paper layer and in the process some of these fibres collect at the tip and at the cutting edge and thus considerably reduce the perforating and cutting effect thereof. This leads to the lower polyethylene layers being more and more extended and stretched and practically sliding over the cutting edge protected by the fibres. This leads to the laminated paper being consistently incompletely cut through or in some cases practically even not being cut through at all, so the consumer cannot empty the container at all or the outlet stream is reduced during emptying and discharges in a deflected manner and some of the contents are accordingly spilt.

It is therefore the object of the present invention to improve a closure device of the type mentioned at the outset in such a way that the stated problem for the most part no longer occurs.

A closure device with the features of Claim 1 achieves this object.

In this case the invention makes use of the knowledge that a tensioned extended and stretched plastics material film may be perforated considerably more easily than a slack

film. In cases where the closure device is not pierced and cut directly from the start by the at least one cutting element, the film which has not been cut through will be extended and oriented and in the tensioned state will come to rest on the at least one perforating tooth following the cutting edge and located lower than it and will, with a high degree of certainty, be pierced accordingly. The film tears in the process and the cutting operation will continue as desired.

Further advantageous configurations of the subject of the invention emerge from the dependent claims and the significance and mode of operation thereof is explained in the following description with reference to the accompanying drawings.

In the drawings:

Fig. 1 shows a first embodiment of a closure device in a vertical diametrical section, the closure device being shown in the assembled state prior to the first use, while

Fig. 2 also shows a vertical cross-section of the closure device in the state of use with the screw cap unscrewed.

Fig. 3 shows a second embodiment of a closure device in the non-assembled state in a side view.

Fig. 4 shows a development of a piercing element in a first preferred embodiment and

Fig. 5 shows a similar development of a second advantageous configuration.

While Fig. 1 to 3 are used merely to clarify and describe two embodiments of a closure device, to which the development according to the invention may be applied, the actual invention is preferably illustrated in Fig. 4 and 5.

Fig. 1 and 3 show the closure devices that are of interest here in their entirety in both cases, the closure device in Fig. 1 being shown in the assembled state before the first use while Fig. 3 shows, in an exploded view, only the three main elements before their assembly. Fig. 2 on the other hand, shows the closure device according to Fig. 1 in the state of use after the screw cap has been fully unscrewed, the piercing element being accordingly located in a lowest position.

The closure device according to the invention comprises the three main components, namely a stopper-like lower part 2 in which a piercing element 3 can be moved downwards in a screw-like manner, and a screw cap 4 which has the function of closing the stopper-like lower part 2 and of causing the piercing element 3 to rotate during the unscrewing operation on the first opening and of causing the piercing element to move downwards in the process.

The actual container is only partially shown and is designated by the letter B. The container, as already mentioned, consists of what is referred to as laminated paper and has a pre-punched portion V. The pre-punched portion V should optimally be located such that it comes to rest exactly concentrically in the opening of the stopper-like lower part. At the same time the pre-punched portion should in turn optimally be provided at a depth such that only the innermost two layers of aluminium foil and polyethylene film remain undamaged. The closure device is welded or glued to this container B made of multi-layer laminated paper. For this purpose, the stopper-like lower part 2 has a flange 21 which is formed on the lower edge of a cylindrical connection piece 20. This outlet connection piece 20 has an internal thread 22 and an external thread 23 and a plurality of retaining cams 24 formed below the external thread 23. The piercing element 3, which comprises a cylindrical ring 31 with external thread 32, and which has a cutting element 33 and a deflector 34, runs in said internal thread 22. As mentioned this piercing element 3 is actuated by means of the screw cap 4. For this purpose, the screw cap 4, below its top surface 40, comprises a tappet 44 which engages with interlocking fit on the inner wall of the piercing element 3. If the piercing element 3 is in its lowest position after the first opening, as shown in Fig. 2, the tappet is automatically no longer engaged and will no longer engage with the piercing element 3 even on subsequent closure of the closure device. The screw cap 4 also comprises an anti-tamper strip 45 which is connected by pre-determined breaking point bridges 46 to the casing wall 41 of the screw cap 4. Prior to the first opening said retaining cams 24 engage between the pre-determined breaking point bridges 46 and thus ensure that the screw cap 4 cannot be unscrewed without detaching the anti-tamper strip 4.

The piercing element 3 comprises, as already mentioned, a cylindrical ring 31, on the lower extension of which one or more cutting elements 33 are formed. In addition there is optionally a deflector 34 on this ring 31. The two closure devices 1 according to Fig. 1 and Fig. 3 differ in this aspect. However, each cutting element 33 does consistently have a leading tip 36 and a cutting edge 37 which, in a manner directly adjoining the leading tip 36, extends in a straight line or in an inclined manner toward the lower edge of the cylindrical ring.

Fig. 4 shows on an enlarged scale and in its embodiment according to the invention a development of a piercing element 3 as is used in the closure device 1 according to Fig. 3. The cutting element 33 is formed on the ring 31, which can be seen in its developed form here, on its lower edge. The cylindrical ring 31 has an external thread 32. The cutting element 33 substantially has the form of a saw tooth here. The directions used for definition are, on the one hand, the cutting direction indicated by the arrow S and, on the other hand, the direction of penetration which is shown by the arrow E. The cutting element 33 has a tip 36 which is leading with respect to the cutting direction and at the same time is likewise located foremost in the direction of penetration E. This leading direction is also the lowest point, with respect to the ring 31, in other words the point which comes to rest on the laminated film first when the container B is cut open. A cutting edge 37 follows this leading tip 36. In the embodiment according to Fig. 4, this cutting edge 37 extends from the leading tip 36 exactly perpendicularly to the cylindrical ring 31, in a manner directed toward the lower edge thereof. Following the leading tip 36 in the cutting direction S there is a descending edge 35 that is inclined toward the lower edge of the ring 31. According to the invention a perforating tooth 38 is formed on this descending edge 35. If it is assumed that, for the reasons mentioned at the outset, the polyethylene film layer has not been pierced by the leading tip 36 and consequently is not cut open by the cutting edge 37 either, the laminated paper stretches, provided it is not cut, with one or more of its layers made of plastics material and is tensioned over the cutting element 33, the film resting over the cutting element 33, on the one hand, and being pulled toward the as yet uncut region of the container B, on the other hand. In the process sooner or later it comes to rest, in its tensioned state, on the tip of the perforating tooth 38. The accordingly extended and stretched film that is tensioned is accordingly pierced considerably more easily owing to the existence of this tension and stretching, similar to as is the case with an inflated balloon. It is important that, with respect to the penetration depth, the perforating tooth 38 is not as far removed from the lower edge of the ring 31 as the leading tip 36. With respect to the penetration depth, the perforating tooth 38 is assuredly arranged in the leading half of the maximum penetration depth. While this is not imperative, the reliability of course decreases the closer the perforating tooth comes to rest with respect to the ring 31.

In the embodiment according to Fig. 5, two cutting elements 33 are formed on the piercing element 3 with its cylindrical ring 31. These two cutting elements 33 extend in front of a deflector 34 in the cutting direction S. While the embodiment according to Fig. 4 does not show any specific deflector 34 the descending edge 35 can, as a result of suitable creative measures, by all means also have the function of a deflector. In such a

way the lower end of the deflector 34 can have a reinforced casing wall. The specific configuration of a deflector, as shown in Fig. 5, is certainly a reliable operating variant, however. The perforating tooth 38 follows the two cutting elements 33 in the cutting direction. This tooth could of course also be formed on the descending edge 35 of the cutting element 33 that trails in the cutting direction. In this case, however, this perforating tooth would have to project further from the lower edge of the ring 31 in the direction of penetration than the highest point of the following deflector 34 in the direction of penetration E. In the example illustrated here however, the perforating tooth is formed on the deflector 34 and forms the highest point in the direction of penetration E. The perforating tooth 38 is in turn formed on an elevation 39 of the deflector 34 in this case.

The two embodiments illustrated here thus show that the cylindrical piercing element can be equipped with one or more cutting element(s). Of course it would also be conceivable to provide more than one perforating tooth, for instance two thereof. In an embodiment according to Fig. 4 the two perforating teeth 38 would be arranged in the region of the descending edge 35 but at two different heights. It could also be sensible to form two such perforating teeth relatively close to each other.

In the embodiments according to Fig. 5, as described above, a plurality of perforating teeth 38 could again be provided, wherein the perforating teeth can, for example, be provided on the descending flank 35 or on the deflector 34. If the piercing element is provided with more than one cutting element 33, it has proven sensible for what are referred to as the tips 36 of the cutting elements 33 to be arranged at an at least approximately equal distance from the nearest, here the lower, edge of the ring 31. These define a level N which is shown in dot-dash lines and the perforating tooth or teeth 38 should be located between this level and the lower edge of the ring 31.

List of reference numerals

1	Closure device
2	Lower part
3	Piercing element
4	Screw cap
20	Outlet connection piece cylindrical
21	Flange
22	Internal thread
23	External thread
24	Retaining cams
31	Ring cylindrical
32	External thread
33	Cutting elements
34	Deflector
35	Descending edge
36	Leading tip
37	Cutting edge
38	Perforating tooth
39	Elevation
40	Top surface
41	Casing wall
42	Internal thread
43	Concentric annular wall
44	Tappet
45	Anti-tamper strip
46	Desired breaking point bridges
B	Container
E	Penetrating device
S	Cutting direction
V	Pre-punched portion